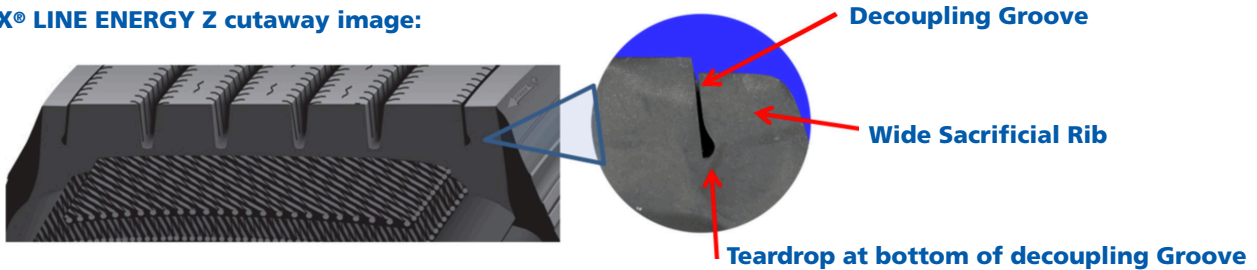


Heat Effects on MICHELIN® X® Line Energy Z Steer Tires

Sacrificial Rib / Decoupling Groove:

The MICHELIN® X® Line Energy Z line haul steer tire design includes a “Sacrificial Shoulder Rib” separated from the main shoulder rib by a narrow “Decoupling Groove”. Combined, these two features help to mitigate the onset and spread of irregular wear thereby contributing to long, even wearing tread life, especially in slow wear rate applications.

X® LINE ENERGY Z cutaway image:



While the Sacrificial Rib and Decoupling Groove features serve an important purpose in extending tire tread life, they can be susceptible to damages, including:

- Splitting or tearing at the bottom of the decoupling groove
- Chunking out of the sacrificial rib
- Tearing down the sidewall

These damages are generally slow to propagate, easily detectable via periodic visual inspection of the tire, and do not pose an immediate risk to the integrity of the tire.

Tires offered by other manufacturers that incorporate similar sacrificial rib/decoupling groove features are susceptible to similar damages. These conditions are not unique to the MICHELIN® X® Line Energy Z tire.

Factors that can contribute to these damages included the following:

- Low or zero-speed turning, especially on aggressive surfaces
- Over flexing of the sacrificial rib during operation in more regional, high scrub applications
- Road hazards impacts such as potholes, curbs and transitioning across steps in the pavement
- Operating at elevated temperatures

For more details and advice on what to do if your tires experience the damages described above, see the Michelin Technical Bulletin “Sacrificial Rib Decoupling Groove Damage” which can be found under the Reference Documents section of the Toolbox on the Michelin website – <https://business.michelinman.com>.

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Heat Effects on Rubber Performance:

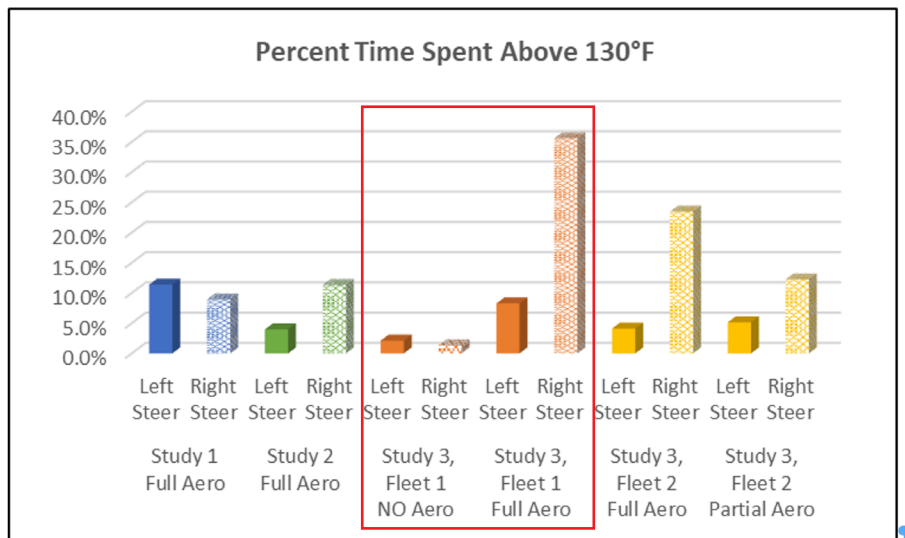
It is a well-known fact that temperature plays an important role in tire performance and tire endurance. Long-term exposure to elevated temperatures has a negative and cumulative impact on tire rubber. Rubber becomes more brittle and more susceptible to cracking with increased exposure to elevated temperatures. Additionally, the reaction rate... the speed at which the rubber properties degrade... increases exponentially with increasing temperature. The hotter the operating environment, the faster the rubber degrades.

Industry Changes:

Today's Class 8 semi-tractors are evolving in order to improve fuel economy and meet EPA Greenhouse Gas (GHG) emissions requirements. Vehicle aerodynamics are a key part of the progress for GHG emissions and include such items as low ground clearance bumpers, fender close-outs and side skirts, as illustrated in these images.



To understand the impacts of these new aerodynamic features, Michelin has conducted numerous, under-fender temperature studies on a variety of modern class-8 semi-tractors with various configurations of aerodynamic packages. These studies have confirmed that the use of certain aerodynamic features are causing average temperatures around the tire to increase by as much as 24°F over previous generation tractors without such features. In addition, time spent at these elevated temperatures is also increasing. In the chart, it can be seen that time spent above 130°F (chosen as consistent reference) for a previous generation tractor with no aerodynamic skirting or low ground clearance bumper was less than 2.1% (Study 3, Fleet 1, No Aero). In contrast, time spent above 130°F for the same make and model tractor equipped with the latest generation , aero package was measured at 35.6% (Study 3, Fleet 1, Full Aero)



In addition to changes to vehicle aerodynamics, the usage conditions for steer tires are also impacted by other factors such as changes to vehicle geometry to support a tighter turning radius, changes to transmissions and electronics which can impact the speed in some turns, and evolutions in roads and driving behavior over time. The demands on the tire are generally increasing from all the various usage evolutions in recent years.

Recommendations:

Michelin has long supported efforts to improve vehicle fuel economy and recognizes that there will always be a need to evolve vehicles and components to improve efficiency. While fleets and drivers may not be able to control certain vehicle features, Michelin does offer the following recommendations to maximize the performance from our tires:

- Select an appropriate tire for your vehicle’s usage condition.
- Respect the speed rating of the tires on the vehicle. The speed rating for Michelin tires can be found in the Michelin Truck Tire Data Book under the Reference Documents section of the Toolbox on the Michelin website (<https://business.michelinman.com>)
- Ensure tires are adequately inflated to carry the load. Recommended cold tire inflation pressure can be found on the vehicle placard.
- Do not exceed the load capacity marked on the sidewall of the tire.
- Perform periodic, thorough visual inspections of all tires on the vehicle looking for such conditions as cuts, cracks, bulges, penetrations or irregular wear. Follow industry advice, such as that given in the TMC Radial Tire Conditions Analysis Guide, if conditions of concern are detected. If Sacrificial Rib or Decoupling Groove damage is detected, refer to Michelin Technical Bulletin “Sacrificial Rib Decoupling Groove Damage” which can be found under the Reference Documents section of the Toolbox on the Michelin website (<https://business.michelinman.com>).

How is Michelin Addressing this Concern:

Michelin is carefully monitoring the performance of our tires and working with our Original Equipment and other industry partners to ensure the best overall performance of the vehicle and tires.

Michelin has evolved our X® Line Energy Z tire in early 2023 to improve the sacrificial rib aggression performance in these new, more demanding operating conditions while also ensuring the low rolling resistance and smooth, long lasting wear characteristics for which this tire is known.

Michelin’s Research & Development teams in collaboration with Michelin’s Marketing teams are continuously working to develop new products for the North American Market, including new line haul steer offers which should be available in the near future.